| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/619,634 | 07/15/2003 | Russell L. Lewis | TUC 920030028 US1 (16472) | 1229 |

| | | | EXAMINER |
|---|---|---|---|
| 46263 | 7590 | 05/22/2006 | DARNO, PATRICK A |

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|---|---|
| 2163 | |

DATE MAILED: 05/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | Application No. | Applicant(s) |
|---|---|---|
| **Office Action Summary** | 10/619,634 | LEWIS, RUSSELL L. |
| | Examiner | Art Unit | |
| | Patrick A. Darno | 2163 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED. (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) ☒ Responsive to communication(s) filed on _17 April 2006_.

2a) ☒ This action is **FINAL**.     2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4) ☒ Claim(s) _1-17_ is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) _1-17_ is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on _15 July 2003_ is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All   b) ☐ Some *   c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

## DETAILED ACTION

1.      Claims 1, 3-5, 14, and 16-17 have been amended.  Claims 1-17 are pending in

this office action.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1.      Claims 1-6 and 8-17 are rejected under 35 U.S.C. 103(a) as being unpatentable

over the admitted prior art of U.S. Patent Application Publication Number 2002/0087590

issued to David Francis Bacon et al. (hereinafter "Bacon Prior Art") in further view of

U.S. Patent Number 6,338,159 issued to William Preston Alexander, III et al.

(hereinafter "Alexander").

**Claim 1:**

Bacon Prior Art discloses a garbage collecting method for a memory resource in

a computer system, comprising:

for each of a plurality of objects in the memory resource, maintaining a reference

count based on a number of objects pointing thereto (Bacon Prior Art: paragraph [0004], lines

11-15; Note that the reference uses a reference count to track object references and further maintains the

reference count through continual increments and decrements.),

identifying, based on the associated reference count, which of the plurality of

objects are processed to determine whether or not they are garbage (Bacon Prior Art:

paragraph [0004], lines 11-15; If an object has no references pointing to it, then the object is garbage. It

is further noted that this limitation is not given patentable weight because it sets forth an intended use.).

Bacon Prior Art does not explicitly disclose maintaining a depth value based on a

distance from a global data object; and identifying, based on the associated reference

count, which of the plurality of objects are to be processed to determine whether or not

they are garbage. However, Alexander discloses:

maintaining a depth value based on a distance from a global object data

(Alexander: column 5, lines 24-27 and Fig. 5; The invention presented by Alexander maintains a level

(depth) value for each node based on the number of levels (or the depth) that separate that node from the

root object (global data object). Note Fig. 1 and column 9, lines 32-48 for the computer program product

and computer system claims.); and

identifying based on the associated depth value, which of the plurality of objects

are to be processed to determine whether or not they are garbage (Alexander: column 5,

lines 24-27 and Fig. 5; This reference discloses an invention capable of maintaining a depth (level) value

that is capable of being used to identify whether or not an item is garbage. Further, as noted above, this

limitation is given no patentable weight because it sets forth an intended use. Note Fig. 1 and column 9,

lines 32-48 for the computer program product and computer system claims.)

It would have been obvious to one of ordinary skill in the art at the time the

invention was made to modify the teachings Bacon Prior Art with teachings of Alexander

noted above to create a system to identify garbage based on a reference count **and** a

depth value. The skilled artisan would have been motivated to improve the teachings of

Bacon Prior Art per the above such that the level (or depth) value generated by tracing

could be used in the memory allocation and deallocation process (Alexander: column 2,

lines 42-43).

**Claim 2:**

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 1, as noted above, and Alexander further discloses wherein:

for each object, the depth value is maintained by providing a depth field in

metadata associated with the object (Alexander: Fig. 5, 130; The Level (depth) column is

metadata for the traced object.).

**Claim 3:**

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 1, as noted above, and Bacon Prior Art further discloses a first of the objects is

identified for processing when it is determined that a second of the objects previously

pointing thereto is no longer pointing thereto (Bacon Prior Art [0013], lines 1-12 and Fig. 2).

Bacon Prior Art does not explicitly disclose wherein the depth value of the

second object is one less than the depth value of the first object. However, Alexander

discloses wherein the depth value of the second object is one less than the depth value

of the first object (Alexander: Fig. 5, column 130).

It would have been obvious to one of ordinary skill in the art at the time the

invention was made to modify the invention of Bacon Prior Art with the teachings of

Alexander noted above for the purpose of using both a reference count and a depth

value in the garbage collecting process. The skilled artisan would have been motivated

to improve the invention of Bacon Prior Art per the above such that the level (or depth)

value generated by tracing could be used in the memory allocation and deallocation

process (Alexander: column 2, lines 42-43).

## Claim 4:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 3, as noted above, and Bacon Prior Art further discloses the second object is no

longer pointing to the first object because the second object was destroyed (Bacon Prior

Art: paragraph [0013], lines 9-12; This reference shows a node being removed (destroyed).  A node that is

removed (destroyed) can no longer point to any other objects.  Furthermore, it is obvious that if the second

object is destroyed that it is no longer pointing to a first object).

## Claim 5:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 3, as noted above, and Bacon Prior Art further discloses the second object is no

longer pointing to the first object because the second object was reset to point to

another object (Bacon Prior Art: paragraph [0012], lines 1-4; This reference shows tracking a

reference count for an object.  As a computer program executes, pointers are setting and resetting

constantly to reflect changes in the program.  It is obvious that at some point a given object will no longer

point to another object.  The reference counting algorithm disclosed by Bacon Prior Art then identifies an

item as garbage when no more pointers point a particular object.).

## Claim 6:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 1, as noted above, and Alexander further discloses wherein the distance for each

of the plurality of objects is based on a number of objects linking the each of the plurality

of objects to the global data object (Alexander: Fig. 5 and column 5, 24-27; The level (or distance)

of each node (object) is based on the number of links to the root of the tree.).

## Claim 8:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 1, as noted above, and Alexander further discloses initializing the depth value of a

new object created at runtime to one more than the depth value of an object that points

to the new object and links the new object to the global data object (Alexander: Fig. 5 and

column 5, lines 24-27; Note that every new object (node) in the tree has an increasing level count as

shown by the table in Fig. 5.).

## Claim 9:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 1, as noted above, and Bacon Prior Art further discloses when a particular one of

the objects that is processed is determined to be garbage, its associated portion of the

memory resource is made available for re-allocation (Bacon Prior Art: paragraph [0013], lines

7-12; The phrase "node may be removed" indicates that the node was recognized as garbage and will be

removed from memory. When the garbage is removed from memory the memory resource is effectively

available for re-allocation. This is the purpose of garbage collection and this fact is very well known in

the art.).

## Claim 10:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 1, as noted above, and Alexander further discloses wherein when a particular one

of the objects that is processed is determined to be non-garbage, its depth value, and

the depth values of other ones of the objects that are pointed to by the particular object

and linked to the global data object thereby, are reset (Alexander: column 5, lines 24-27 and

Fig. 5; By resetting the depth (level) value of the root object in Fig. 5, the depth value of all the objects

pointed to by that object would also reset. This is because the root would initialize to zero and the nodes

the root points to will have a level (or depth) value that counts up from zero.).

## Claim 11:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 10, as noted above, and Alexander further discloses the depth values of objects

that are pointed to by the other ones of the objects whose depth values are reset, and

linked to the global data object thereby, are also reset (Alexander: column 5, lines 24-27 and

Fig. 5; Same reasoning as rejection for claim 10.).

## Claim 12:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 10, as noted above, and Bacon Prior Art further discloses wherein the particular

object is determined to be non-garbage when it is accessible to outside objects (Bacon

Prior Art: paragraph [0003], lines 1-3 and paragraph [0004], lines 11-15; These references give clear

definitions of what is garbage. Clearly "garbage" is something that is **not** accessible to outside objects.

So all objects that **are** accessible by outside objects are non-garbage. This is very well known in the art.).

## Claim 13:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 10, as noted above, and Alexander further discloses when a new link is created

from a first object of the plurality of objects to a second object of the plurality of objects,

and the first object has a valid depth value but the second object does not have a valid

depth value, the depth value of the second object is initialized to one more than the

depth value of the first object (Alexander: column 5, lines 24-27 and Fig. 5; Note the reference particularly states "counting from the root level zero". And further note Fig. 5 which shows the depth (level) value of each additional node increasing by one for each link to the next object.).

## Claim 14:

The combination of Bacon Prior Art and Alexander discloses all the elements of claim 1, as noted above, and Alexander further discloses initializing a depth value of the global object to a valid depth value (Alexander: column 5, lines 24-27 and Fig. 5; Both of these references display initializing the global object (root) to a depth (level) of 0.).

## Claim 15:

The combination of Bacon Prior Art and Alexander discloses all the elements of claim 12, as noted above, and Alexander further discloses initializing depth values of the plurality of objects to a specified value (Alexander: column 5, lines 24-27; These references show that the depth value of objects are initialized to one more than the depth value of the object linked to it. Note especially "counting from the root as level zero" and also Fig. 5.).

## Claim 16:

Claim 16 is a computer program product claim corresponding to method claim 1 and is rejected under the same reasons set forth in claim 1.

## Claim 17:

Claim 17 is a computer system claim corresponding to method claim 1 and is rejected under the same reasons set forth in claim 1.

**2.**     Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bacon

Prior Art in view of Alexander and further in view of U.S. Patent Application Publication

Number 2002/0087590 issued to David Francis Bacon et al. (hereinafter "Bacon").

## Claim 7:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 6, as noted above, but does not explicitly disclose the objects processed to

determine whether or not they are garbage are processed by a loop detection

mechanism for a reference counting garbage collector.  However, Bacon discloses the

objects processed to determine whether or not they are garbage are processed by a

loop detection mechanism for a reference counting garbage collector (Bacon: paragraph

[0019], lines 1-5).

It would have been obvious for one of ordinary skill in the art at the time the

invention was made to modify the previously mentioned combination with the teachings

of Bacon noted above.  The skilled artisan would have been motivated to improve the

previously mentioned combination such that cycles in a reference counting garbage

collecting method could be detected (Bacon: paragraph [0019], lines 1-5).

### *Response to Arguments*

## Examiner Notes:

The examiner would like to note for the record that the 35 U.S.C. 101 and 35 U.S.C. 112

rejections have been withdrawn after consideration of the applicant's arguments and

amendments.

## Applicant Argues:

The Examiner cites col. 5, lines 24-27 and Figs. 4-5 of Alexander as allegedly teaching maintaining a depth value based on a distance from a global object data, and identifying, based on the associated depth value, which of the plurality of objects are to be processed to determine whether or not they are garbage. Applicant submits that the cited passages have been misinterpreted.

The purpose of the system and method taught by Alexander is to provide trace information in such a way to facilitate understanding of the system's operation.

The cited passages at col. 5, lines 24-27 only teach that Table 5 includes columns of data for Level, RL, Calls, Base, Cum, and Indent and that the Level is the tree level (counting from the root as level 0) of the node. Each node can be traced back to only one root. In other words, no node is a child of two separate roots.

In contrast, Applicant's invention teaches the <u>depth value</u> of an object as the distance of the object from a global data object (the object's position in a reference chain). The object can be referred to by multiple global objects, unlike a node level in a tree.

It is clear that the level of the node taught by Alexander is not at all similar to the depth value recited in Applicant's independent claim 1. Therefore, Alexander does not teach or suggest maintaining a depth value based on a distance from a global object data, and identifying based on the associated depth value, which of the plurality of objects are to be processed to determine whether or not they are garbage.

## Examiner Responds:

Examiner is not persuaded. The Applicant has stated that the examiner has

"misinterpreted" the Alexander reference. The examiner respectfully disagrees. The Alexander

reference clearly teaches tracing through a tree-structure and maintaining a depth value (level

count) from the root (global data object) (Alexander: column 5, lines 24-27 and Fig. 5). In

Alexander's own words, "Level 130 is the tree level (counting from the root as level 0) of the

node." The level value is the "depth" of a particular child node, which represents the child

node's distance from the root (global data object). Furthermore this depth value is "maintained"

in many different ways. Two examples of the level or "depth value" being maintained are in

Figs. 4 and Fig. 5. It is clear from the references cited that Alexander maintains a depth value

from a root object.

Furthermore, the examiner maintains that it would be obvious to one of ordinary skill in

the art to maintain a "depth value" or level value in order to track the distance from any object.

The disclosure by Alexander suggests the use of the level or depth counting, tracing algorithm in

many instances. The examiner also agrees with the applicant that Alexander does suggest using

the trace algorithm to facilitate understanding of the system's operation.

However, Alexander also suggests using this tracing algorithm, which maintains a depth

value, in order to track memory allocation or deallocation (Alexander: column 2, lines 42-43).

Garbage Collection is the process used to deallocate memory. Since Alexander suggests using

the trace algorithm to track memory allocation and deallocation, it is quite obvious that

Alexander clearly suggests using the tracing algorithm, which maintains a depth value, in the

Garbage Collection process. The examiner is drawn to this conclusion because the only way

memory is typically deallocated is through some kind of Garbage Collection process. This

provides strong suggestion to combine the teachings presented by Alexander with any reference

that deals with Garbage Collection.

With respect to the depth value, the applicant has argued many limitations not shown in

the claims. The examiner reminds the applicant that limitations from the specification may not

be read into the claims. For instance, the applicant argues that, "the object can be referred to by

multiple global data objects". However, this added limitation is not found in independent claim

1. It is important to remember that although the claims are interpreted in light of the

specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Finally, the applicant argues that Alexander does not identify a depth value or level value in order to determine whether or not an object is garbage. However, this limitation is not given patentable weight because it simply sets forth the intended use of the maintained depth value. This was clearly indicated to the Applicant in the first non-final office action. Furthermore, the reason or motivation to modify a reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by applicant.

In light of the preceding office action and response to Applicant's arguments, the examiner concludes that Alexander reference does in fact teach the limitation of "maintaining a depth value from a global data object". The examiner further holds that it would have been obvious to one of ordinary skill in the art to use the level value (depth value) disclosed by the Alexander reference in the garbage collection process. Therefore, the rejection with respect to claim 1 under 35 U.S.C. 103(a) are upheld.

## Applicant Argues:

The Examiner states that it would have been obvious to one skilled in the art at the time of the invention to modify the teachings of Bacon with the teachings of Alexander. Bacon discloses techniques for concurrent collection of cyclic garbage in reference counting systems and Alexander discloses a system and method for providing trace information. There is nothing taught or suggested in either references that creates a motivation to combine the references. The Examiner cannot base obviousness upon what a person skilled in the art could, or might, try but rather must consider what the prior art would have led a person skilled in the art to do. In re Antonie, 559 F.2d 618 195 USPQ 6 (CCPA, 1977). To prevent the use of hindsight based on the invention to defeat patentability of the invention, the Examiner must show a motivation to combine the references that create the case of obviousness. In re Rouffet, 47 USPQ2d 1453 (Fed. Cir., July 15, 1998). The conclusion asserted by the Examiner represents an impremissable use of hindsight gained from the present invention.

**Examiner Responds:**

Examiner is not persuaded. The Applicant asserts that there is no motivation to combine

the Alexander and Bacon references. However, Alexander suggests to use his tracing algorithm,

which maintains a depth value, to track memory allocation and deallocation. Garbage Collection

is the process of deallocating memory. Since Alexander suggests to use the tracing method in

the process of deallocating memory and Garbage Collection is the process used for deallocating

memory, the examiner concludes that Alexander suggests to use his tracing method, which

maintains a depth value (level value) in the Garbage Collection process. Since the Bacon

reference is focused on Garbage Collection and the Alexander reference suggests to use the

reference in the Garbage Collection process, the examiner maintains that there is indeed strong

suggestion and motivation to combine the two references.

In light of the preceding discussion, the examiner concludes that the accusations of

hindsight reasoning by the applicant are in fact both not proper and unwarranted. Therefore, the

rejections under 35 U.S.C. 103(a) are upheld.

### Conclusion

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time

policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the mailing date of this final action.
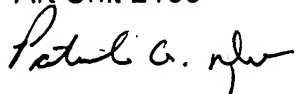
### *Contact Information*

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Patrick A. Darno whose telephone number is (571) 272-

0788. The examiner can normally be reached on Monday - Friday, 9:00 am - 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Don Wong can be reached on (571) 272-1834. The fax phone number for

the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

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Patrick A. Darno
Examiner
Art Unit 2163

PD

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